

Effects of Short- and Long-Duration Space Flight on Neuromuscular Function

Roxanne E. Buxton,¹ Barry A. Spiering,² Jeffrey W. Ryder,³ Lori L. Ploutz-Snyder,³ and Jacob J. Bloomberg⁴
¹University of Houston (Houston, Texas, USA), ²Wyle Integrated Science and Engineering Group (Houston, Texas, USA), ³Universities Space Research Association (Houston, Texas, USA), and ⁴National Aeronautics and Space Administration Lyndon B. Johnson Space Center (Houston, Texas, USA)

The Functional Task Tests (FTT) is an interdisciplinary study designed to correlate the changes in functional tasks (such as emergency egress, ladder climbing, and hatch opening) with changes in neuromuscular, cardiovascular, and sensorimotor function. One aspect of the FTT, the neuromuscular function test, is used to investigate the neuromuscular component underlying changes in the ability of astronauts to perform functional tasks (representative of critical mission tasks) safely and quickly after flight.

PURPOSE

To describe neuromuscular function after short- and long-duration space flight.

METHODS

To date, 5 crewmembers on short-duration (10- to 15-day) missions and 3 on long-duration missions have participated. Crewmembers were assessed 30 days before flight, on landing day (short-duration subjects only) and 1, 6, and 30 days after landing. The interpolated twitch technique, which utilizes a combination of maximal voluntary contractions and electrically evoked contractions, was used to assess the maximal voluntary isometric force (MIF) and central activation capacity of the knee extensors. Leg-press and bench-press devices were used to assess MIF and maximal dynamic power of the lower and upper body respectively. Specifically, power was measured during concentric-only ballistic throws of the leg-press sled and bench-press bar loaded to 40% and 30% of MIF respectively.

RESULTS

Data are currently being collected from both Shuttle and ISS crewmembers. Emerging data indicate that measures of knee extensor muscle function are decreased with long-duration flight.

DISCUSSION

The relationships between flight duration, neural drive, and muscle performance are of particular interest. Ongoing research will add to the current sample size and will focus on defining changes in muscle performance measures after long-duration space flight.